USPTO JC106 JAN 10 2005 PATENT & TRADEMARK OFFICE

Inventor: Alexander Bespalov et al.
Title: Deep Resistivity Transient Method for MWD Applications Using ....
Serial No.: 10/647,483; Filed: August 25, 2003; Confirmation No.: 2366
Docket No.: 414-34865-US; REPLACEMENT SHEET

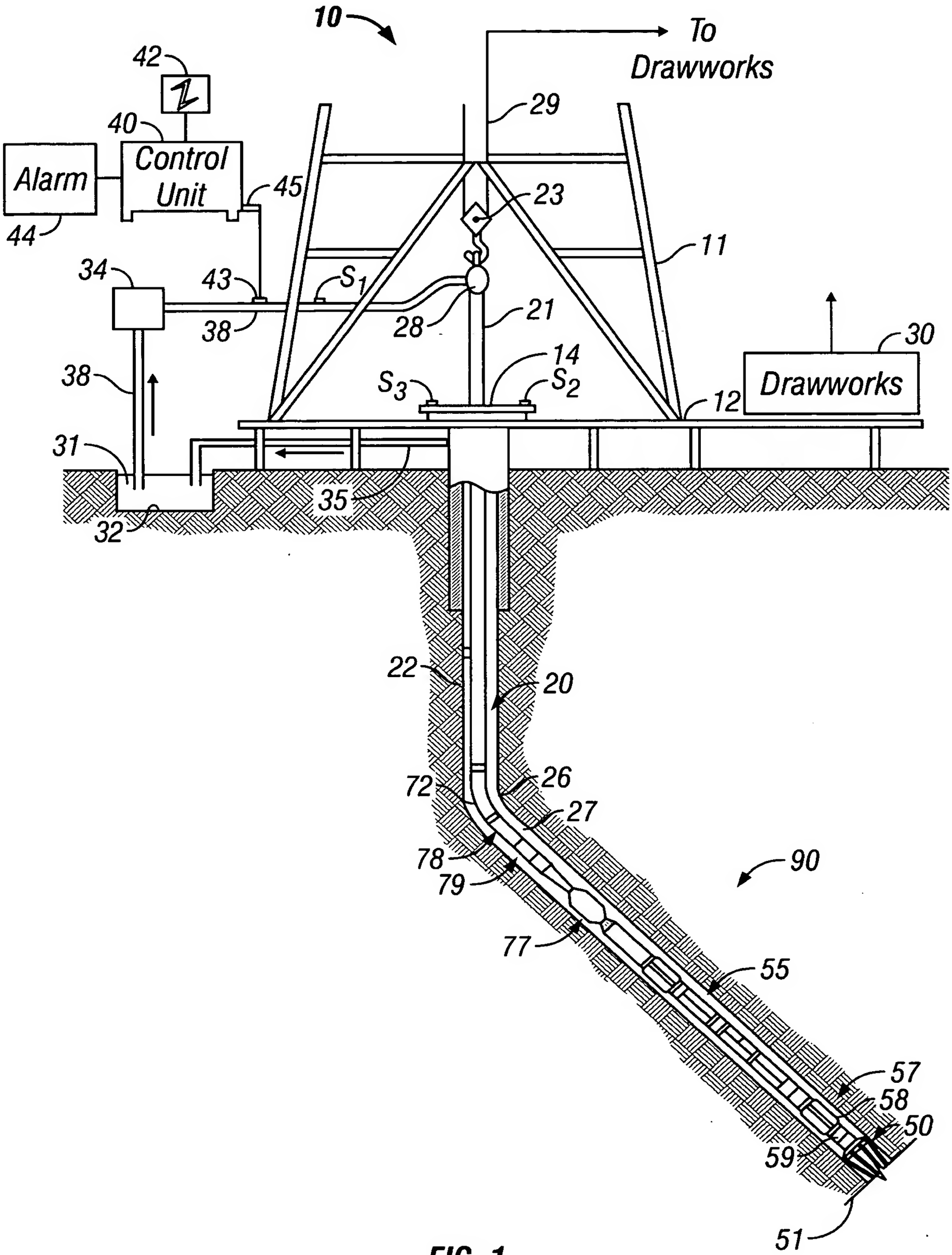

FIG. 1
(Prior Art)

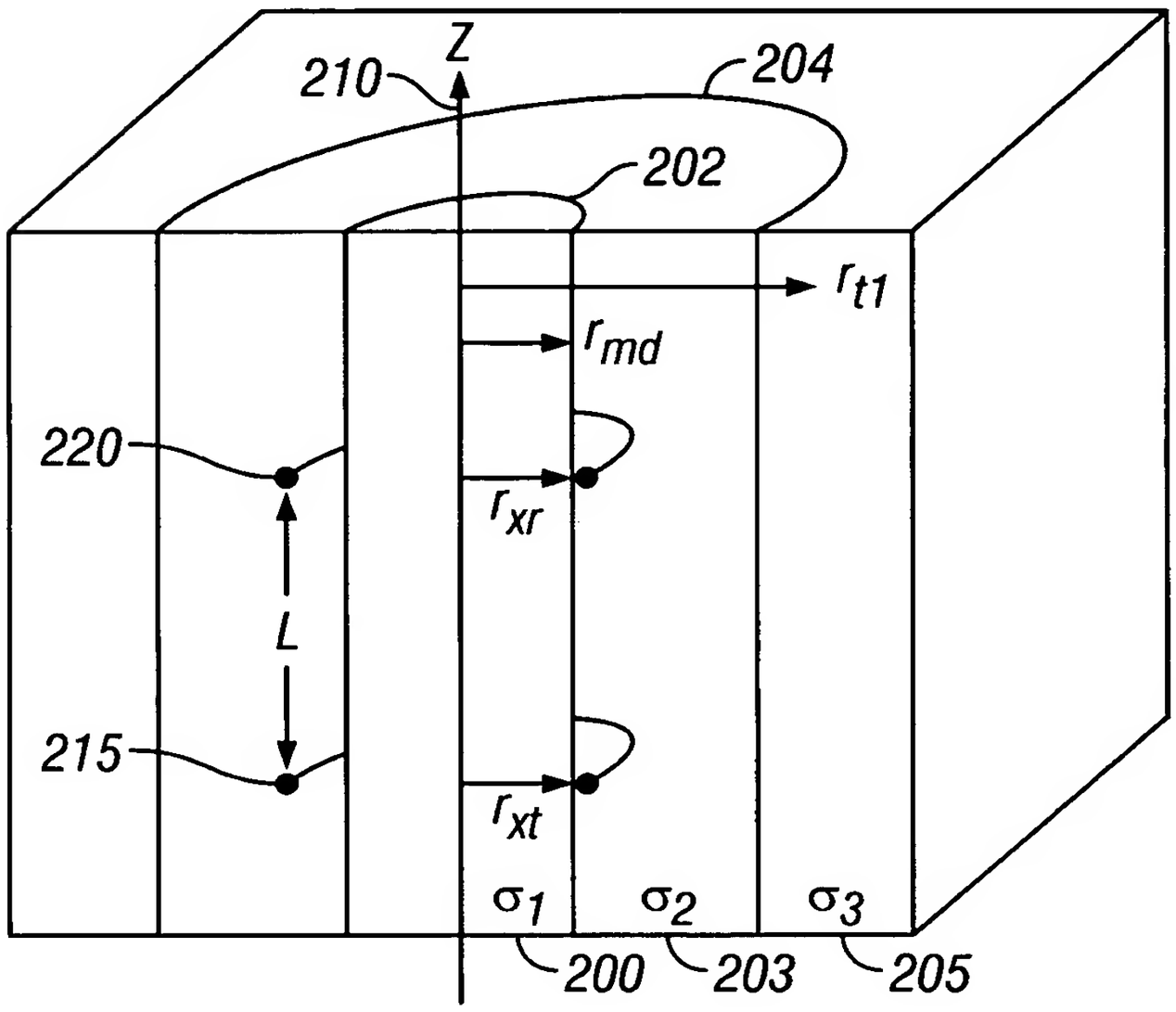
Z
210
204
202
r_{t1}
r_{md}
220
r_{xr}
L
215
r_{xt}
σ_1
σ_2
σ_3
200
203
205

FIG. 2A

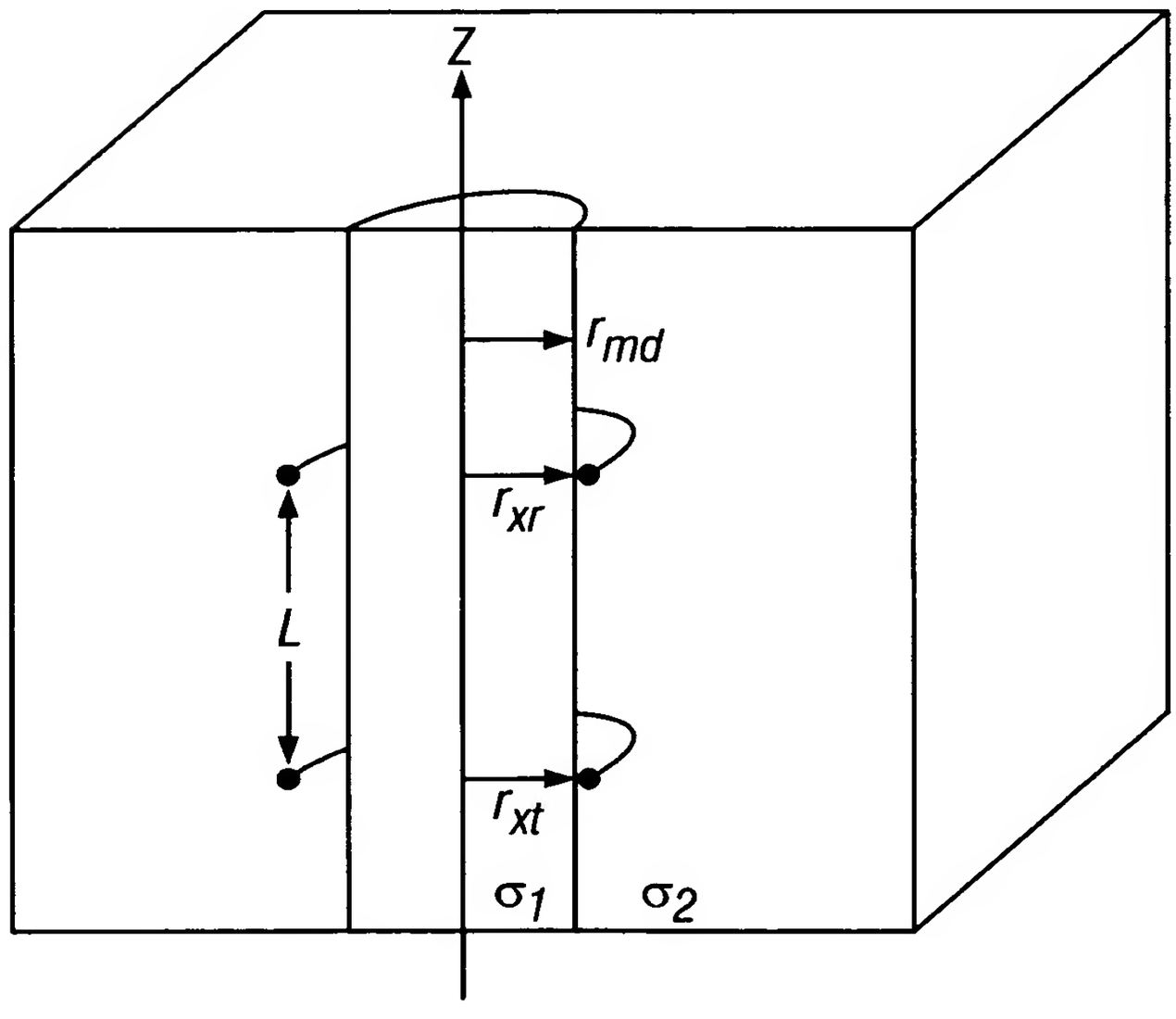
Z
r_{md}
r_{xr}
L
r_{xt}
σ_1
σ_2

FIG. 2B

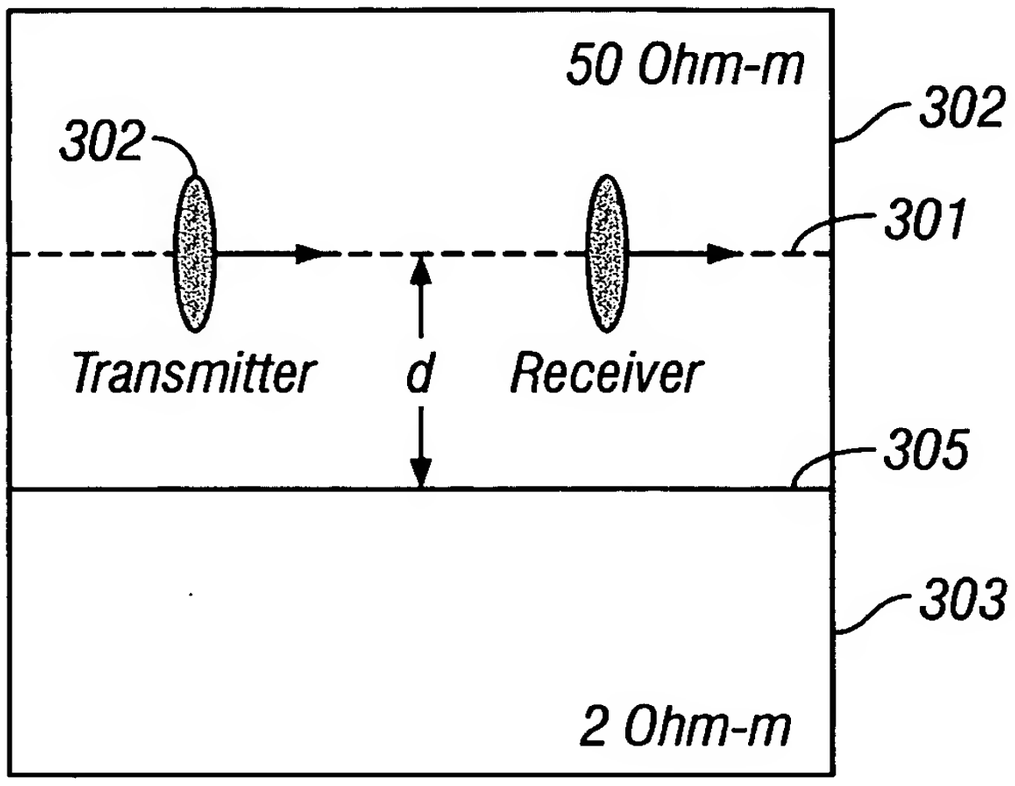
50 Ohm-m
302
302
301
Transmitter
d
Receiver
305
303
2 Ohm-m

FIG. 3

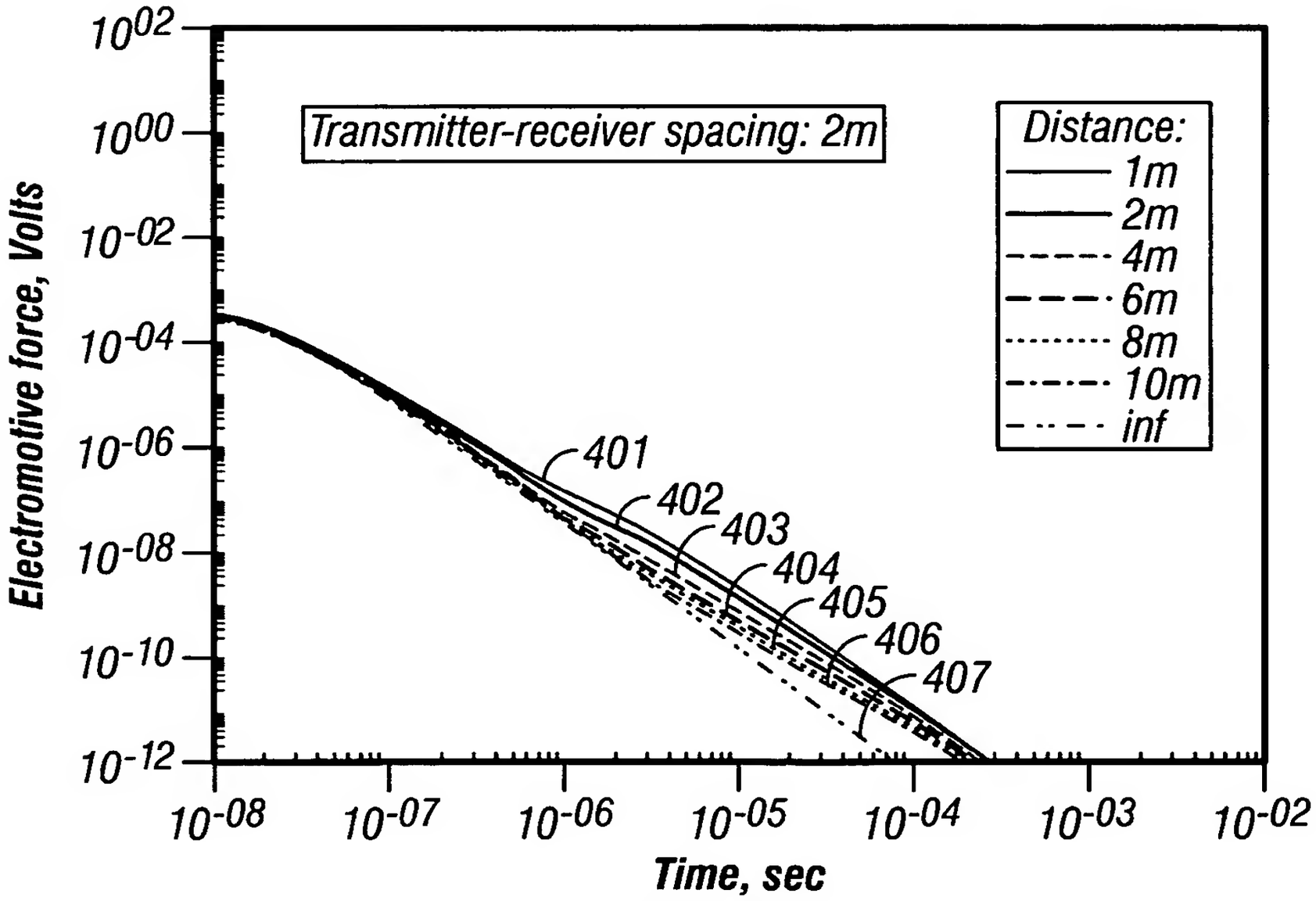
Transmitter-receiver spacing: 2m
Distance:
1m
2m
4m
6m
8m
10m
inf
401
402
403
404
405
406
407
Electromotive force, Volts
Time, sec

FIG. 4

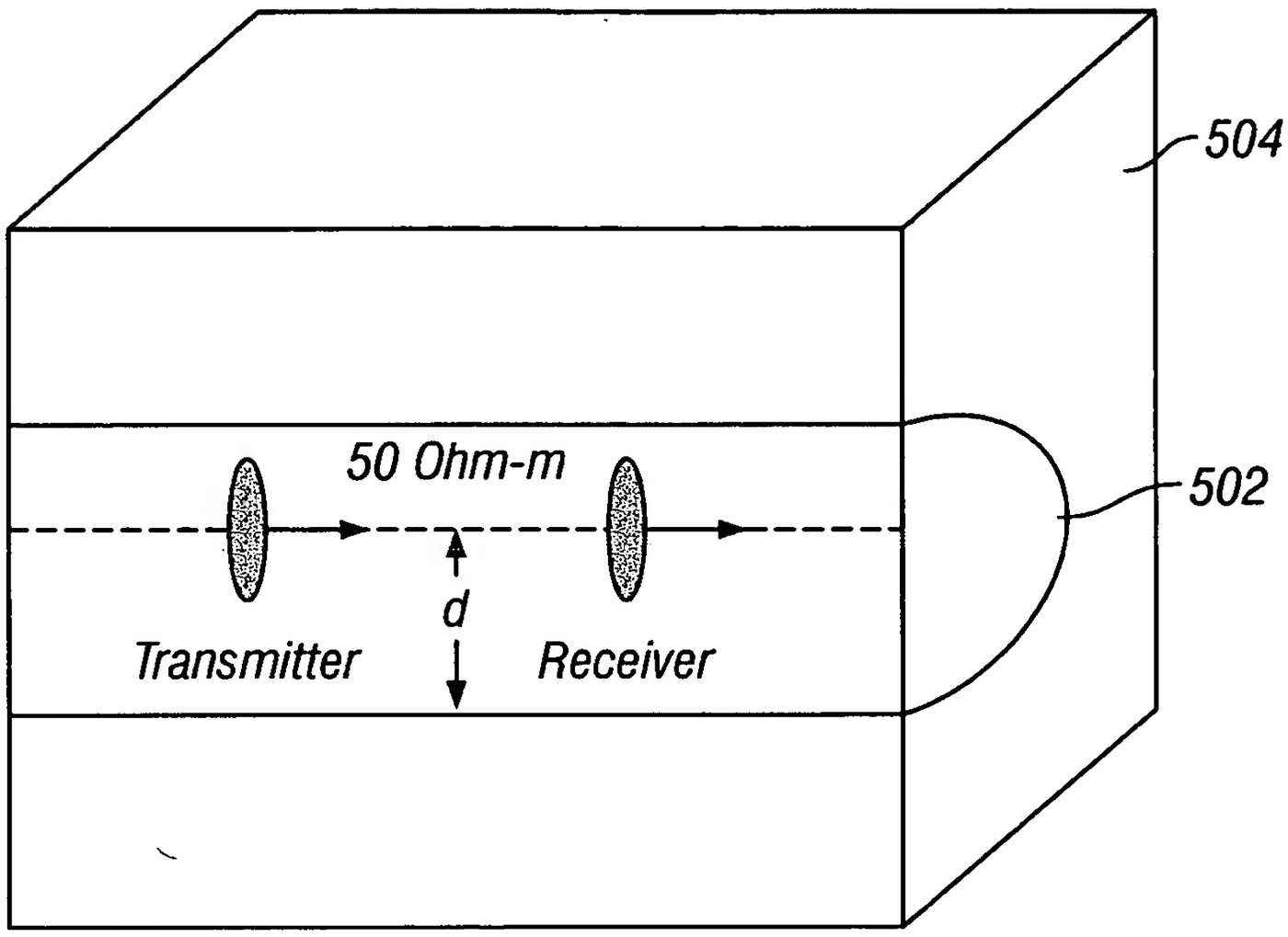
504
50 Ohm-m
502
d
Transmitter
Receiver

FIG. 5

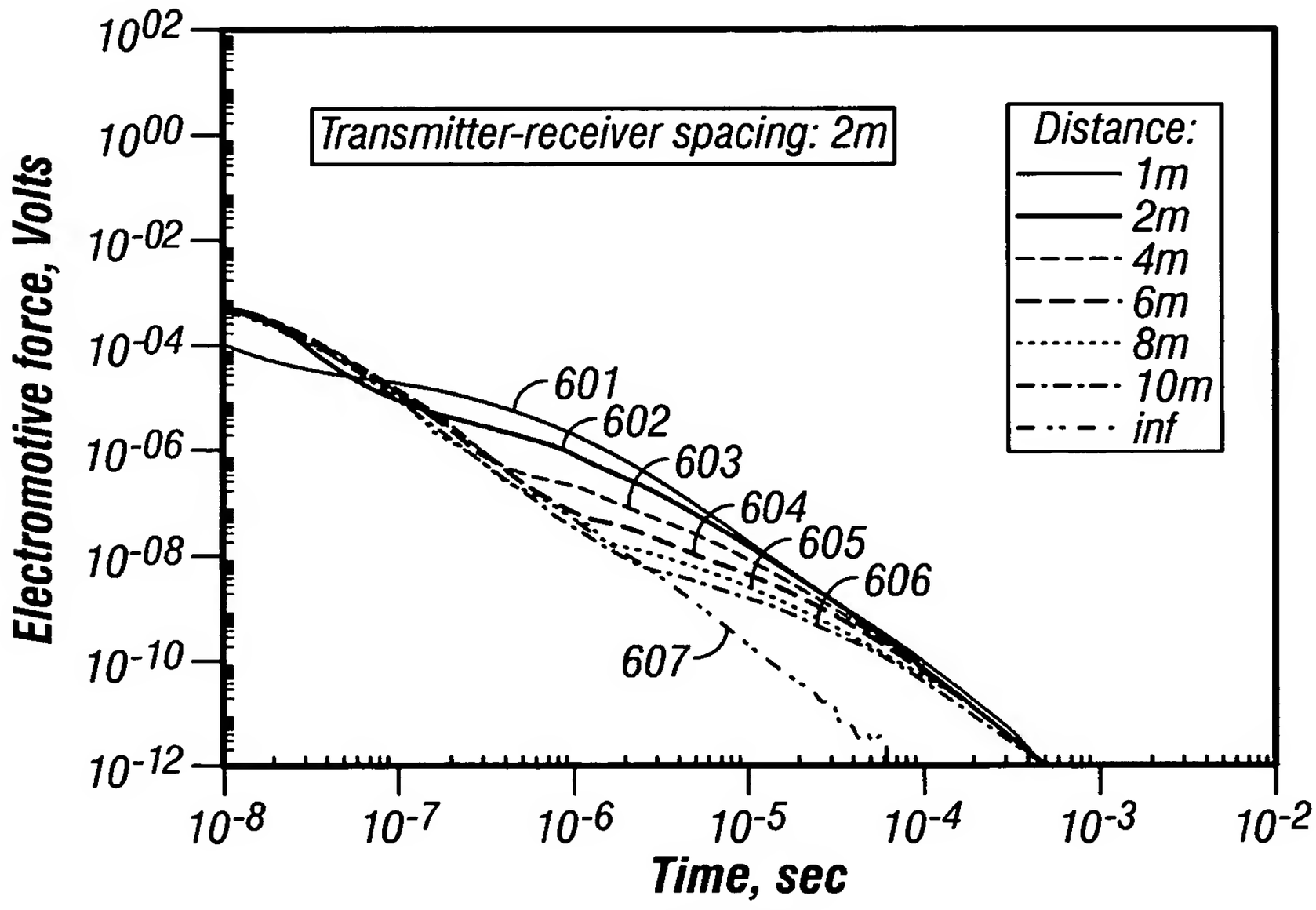
Transmitter-receiver spacing: 2m
Distance:
1m
2m
4m
6m
8m
10m
inf
601
602
603
604
605
606
607
Electromotive force, Volts
Time, sec
10^02
10^00
10^-02
10^-04
10^-06
10^-08
10^-10
10^-12
10^-8
10^-7
10^-6
10^-5
10^-4
10^-3
10^-2

FIG. 6

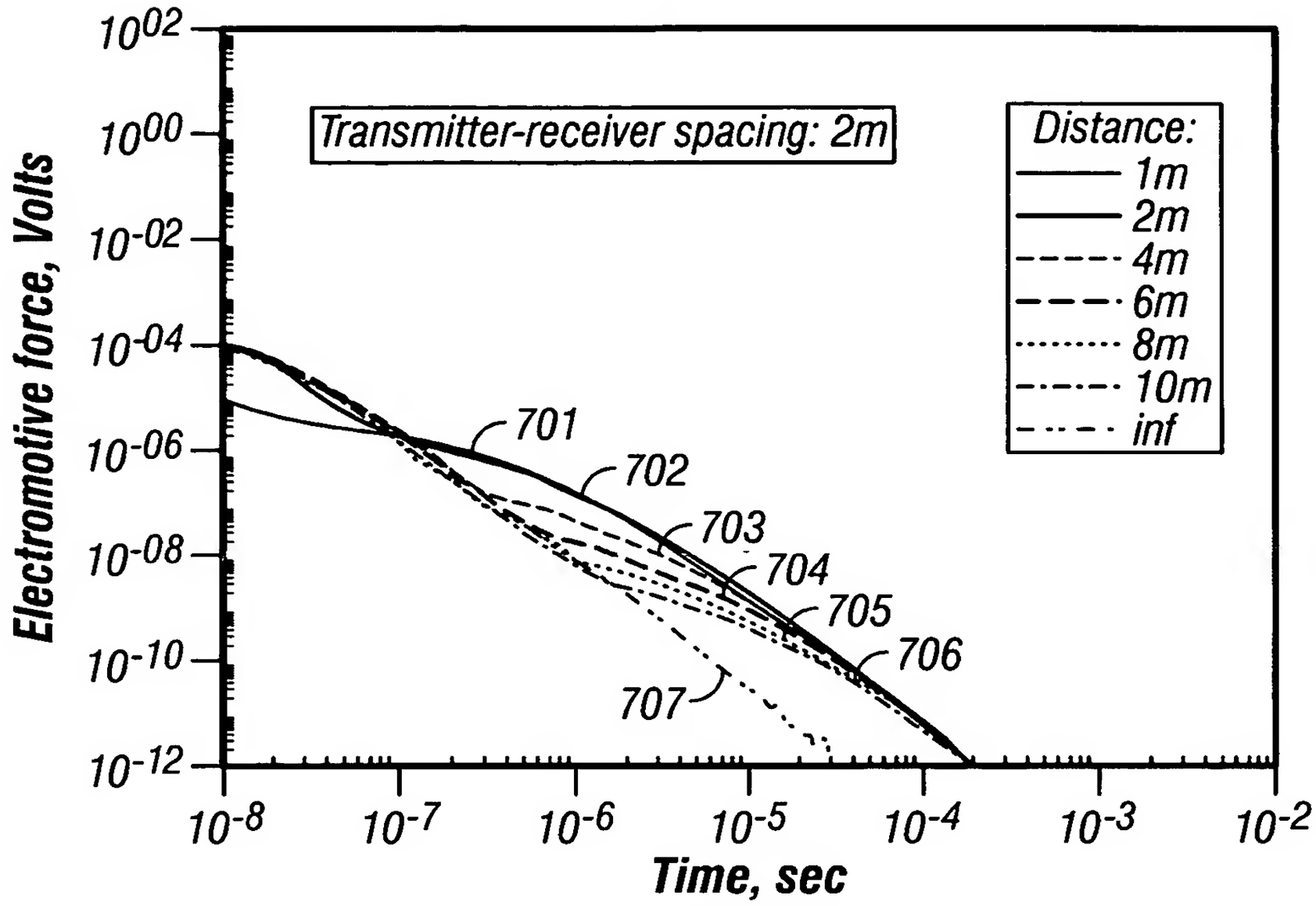
Transmitter-receiver spacing: 2m
Distance:
1m
2m
4m
6m
8m
10m
inf
701
702
703
704
705
706
707
Electromotive force, Volts
Time, sec
10^02
10^00
10^-02
10^-04
10^-06
10^-08
10^-10
10^-12
10^-8
10^-7
10^-6
10^-5
10^-4
10^-3
10^-2

FIG. 7

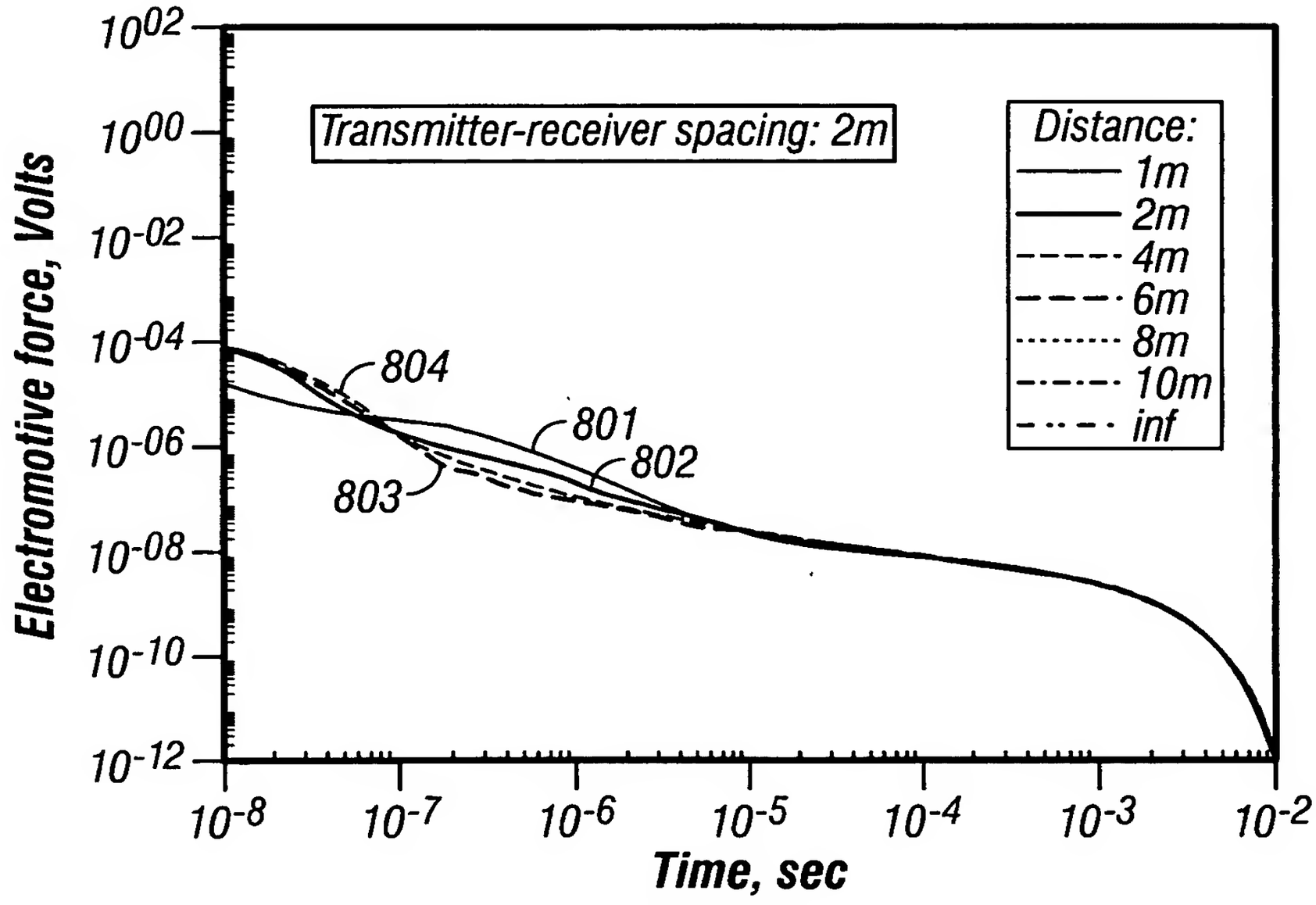
Transmitter-receiver spacing: 2m
Distance:
1m
2m
4m
6m
8m
10m
inf
801
802
803
804
Electromotive force, Volts
Time, sec
10^02
10^00
10^-02
10^-04
10^-06
10^-08
10^-10
10^-12
10^-8
10^-7
10^-6
10^-5
10^-4
10^-3
10^-2

FIG. 8A

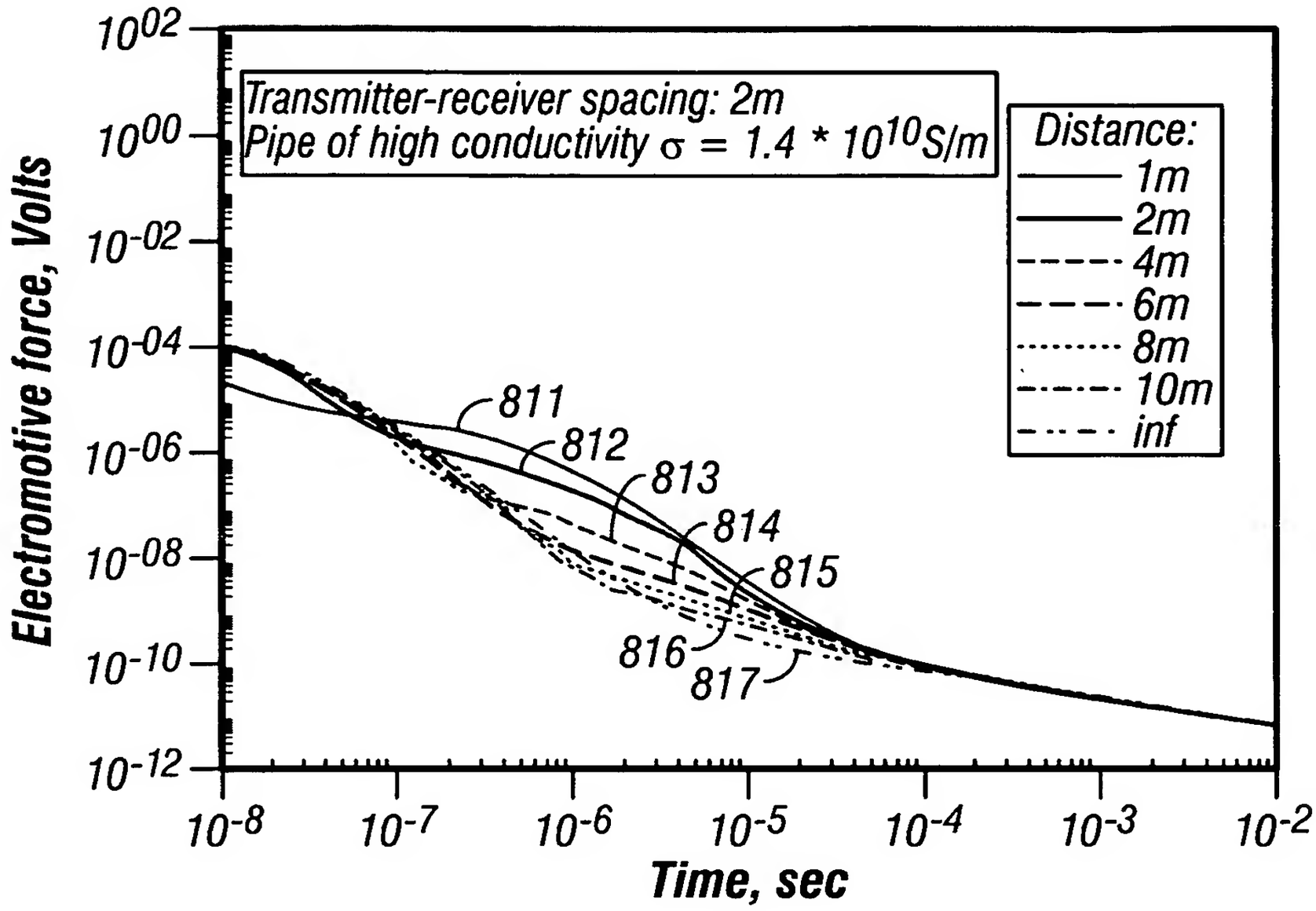
Transmitter-receiver spacing: 2m
Pipe of high conductivity σ = 1.4 * 10^10 S/m
Distance:
1m
2m
4m
6m
8m
10m
inf
811
812
813
814
815
816
817
Electromotive force, Volts
Time, sec

FIG. 8B

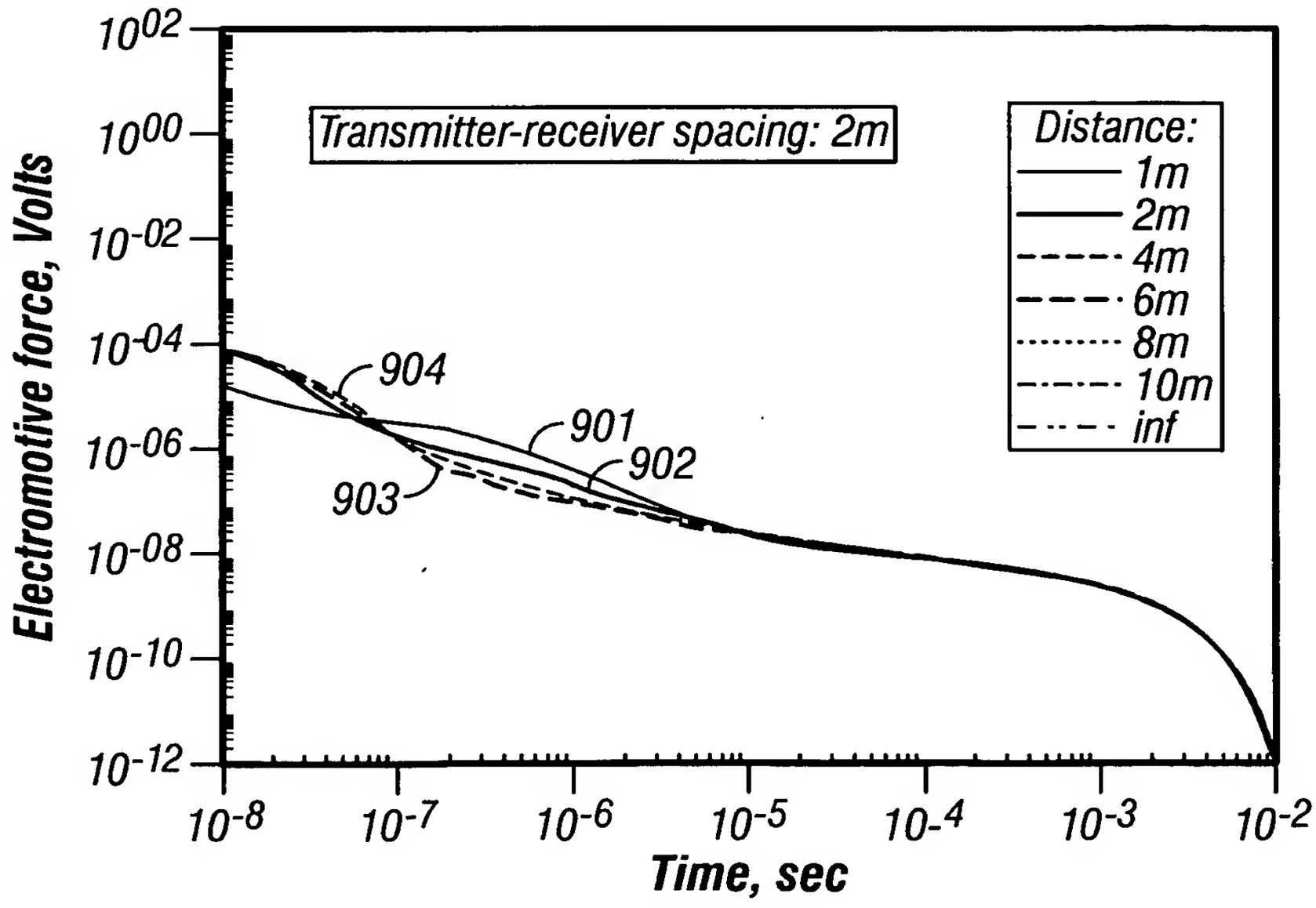
Transmitter-receiver spacing: 2m
Distance:
1m
2m
4m
6m
8m
10m
inf
901
902
903
904
Electromotive force, Volts
Time, sec

FIG. 9

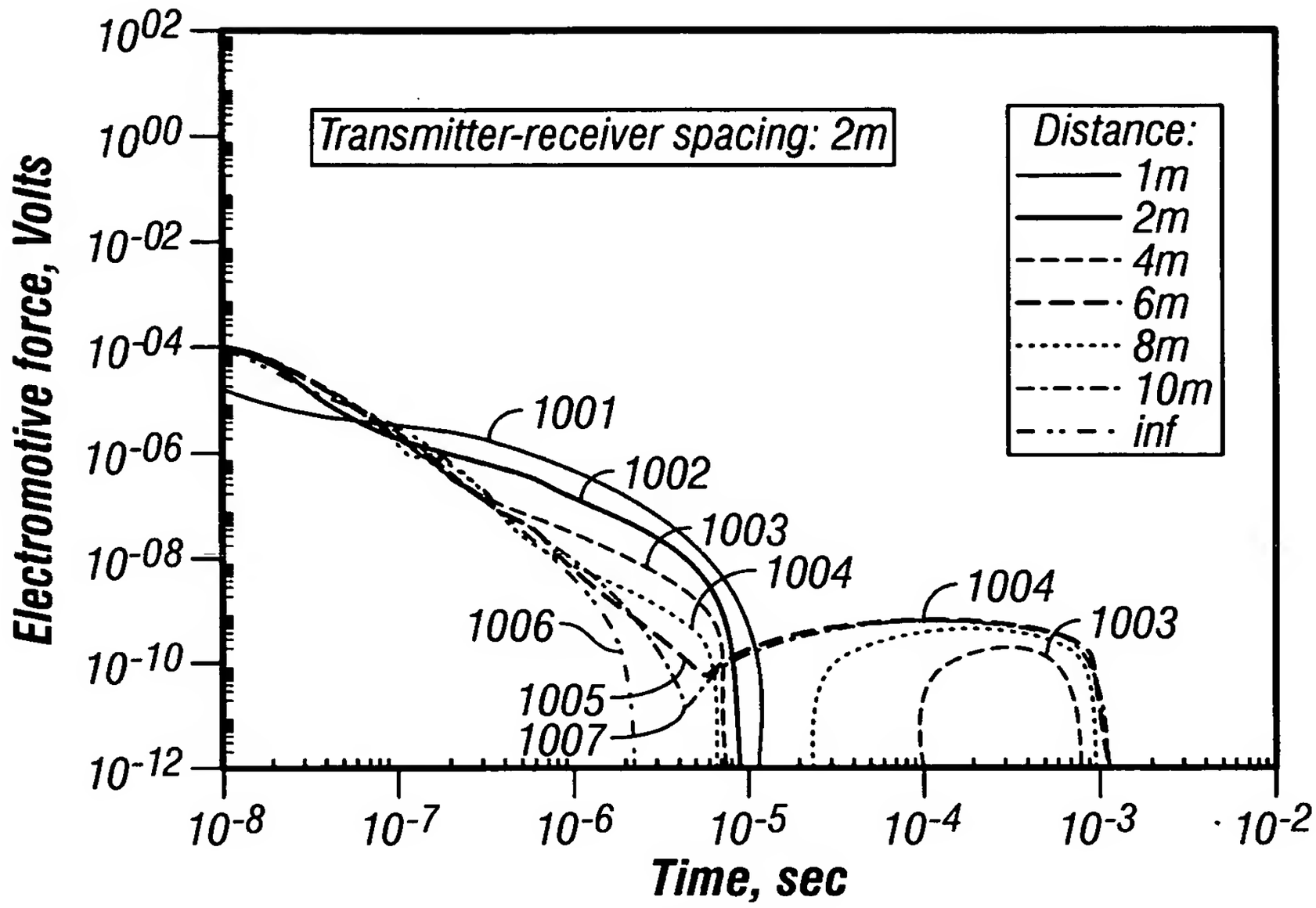
Transmitter-receiver spacing: 2m
Distance:
1m
2m
4m
6m
8m
10m
inf
1001
1002
1003
1004
1004
1003
1006
1005
1007
Electromotive force, Volts
Time, sec
10^02
10^00
10^-02
10^-04
10^-06
10^-08
10^-10
10^-12
10^-8
10^-7
10^-6
10^-5
10^-4
10^-3
10^-2

FIG. 10

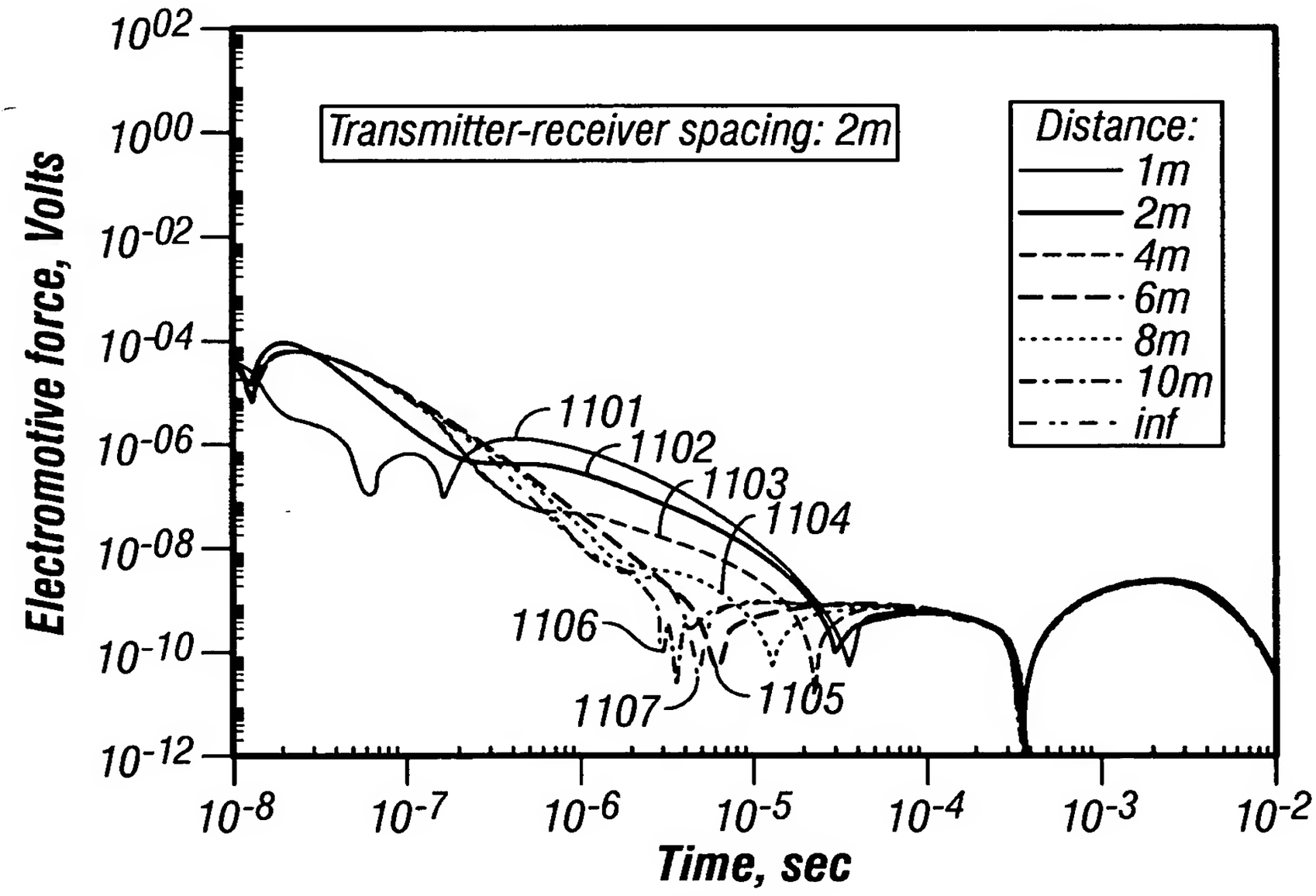
Transmitter-receiver spacing: 2m
Distance:
1m
2m
4m
6m
8m
10m
inf
1101
1102
1103
1104
1106
1107
1105
Electromotive force, Volts
Time, sec
10^02
10^00
10^-02
10^-04
10^-06
10^-08
10^-10
10^-12
10^-8
10^-7
10^-6
10^-5
10^-4
10^-3
10^-2

FIG. 11

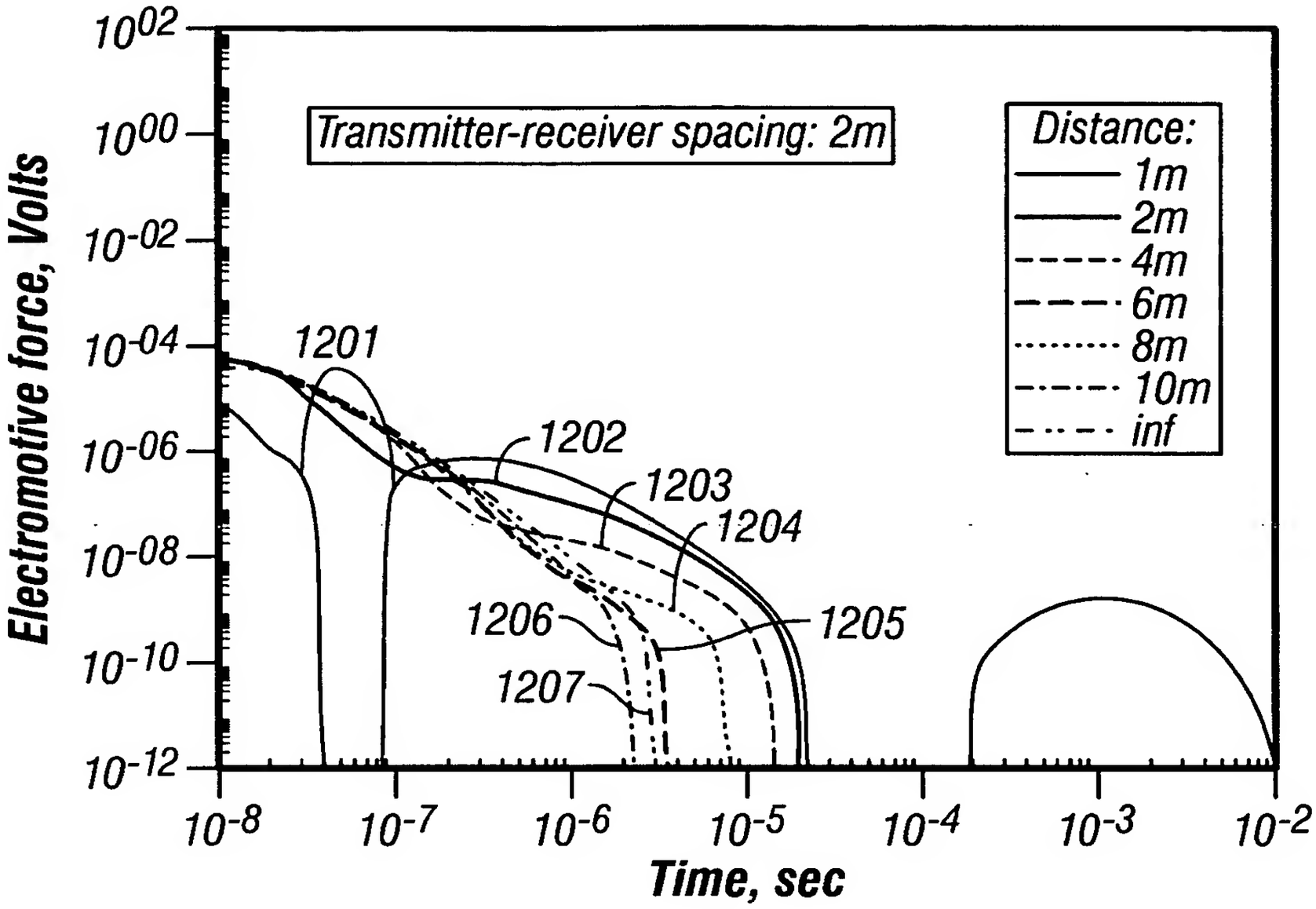

FIG. 12

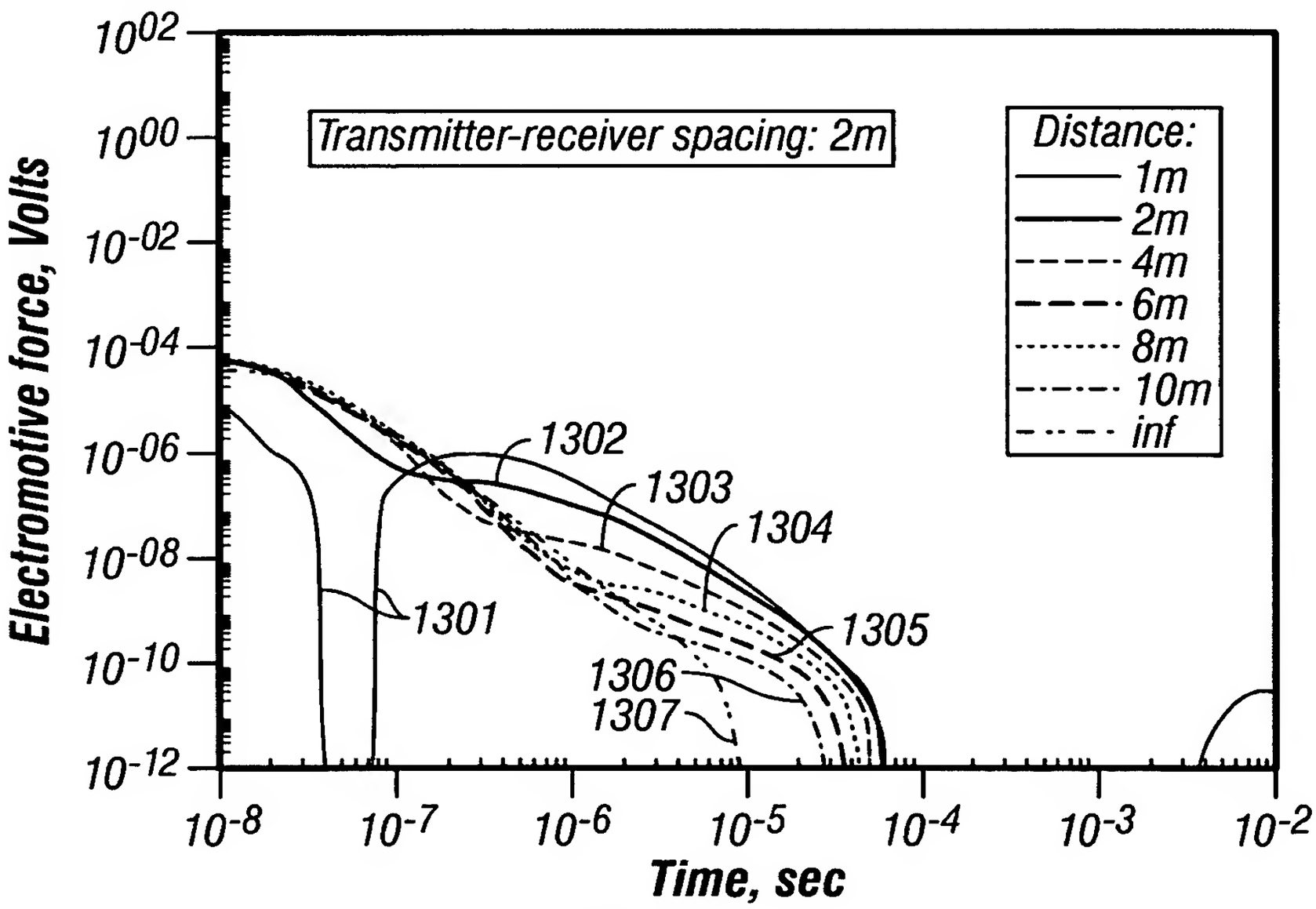

FIG. 13A

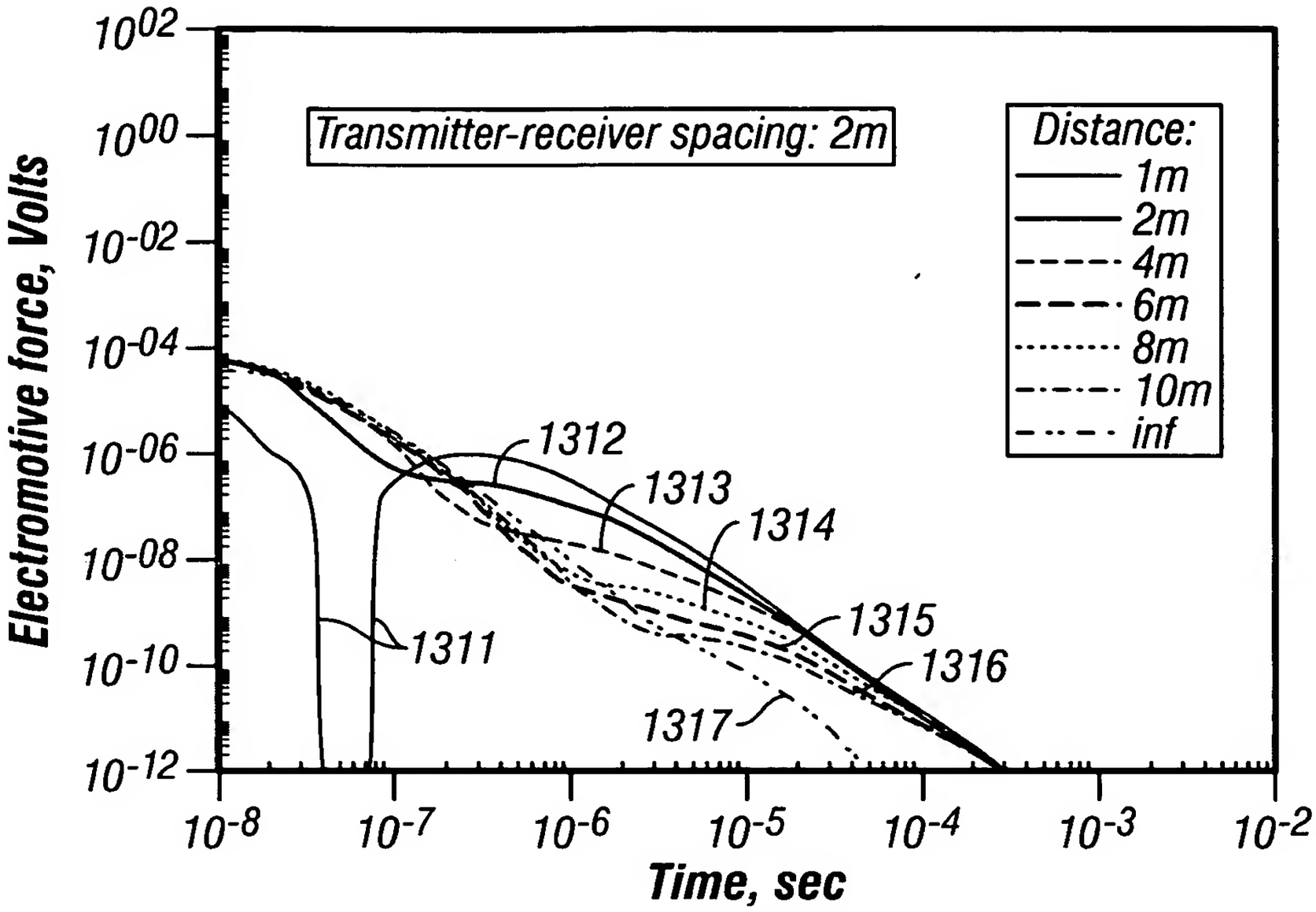

FIG. 13B

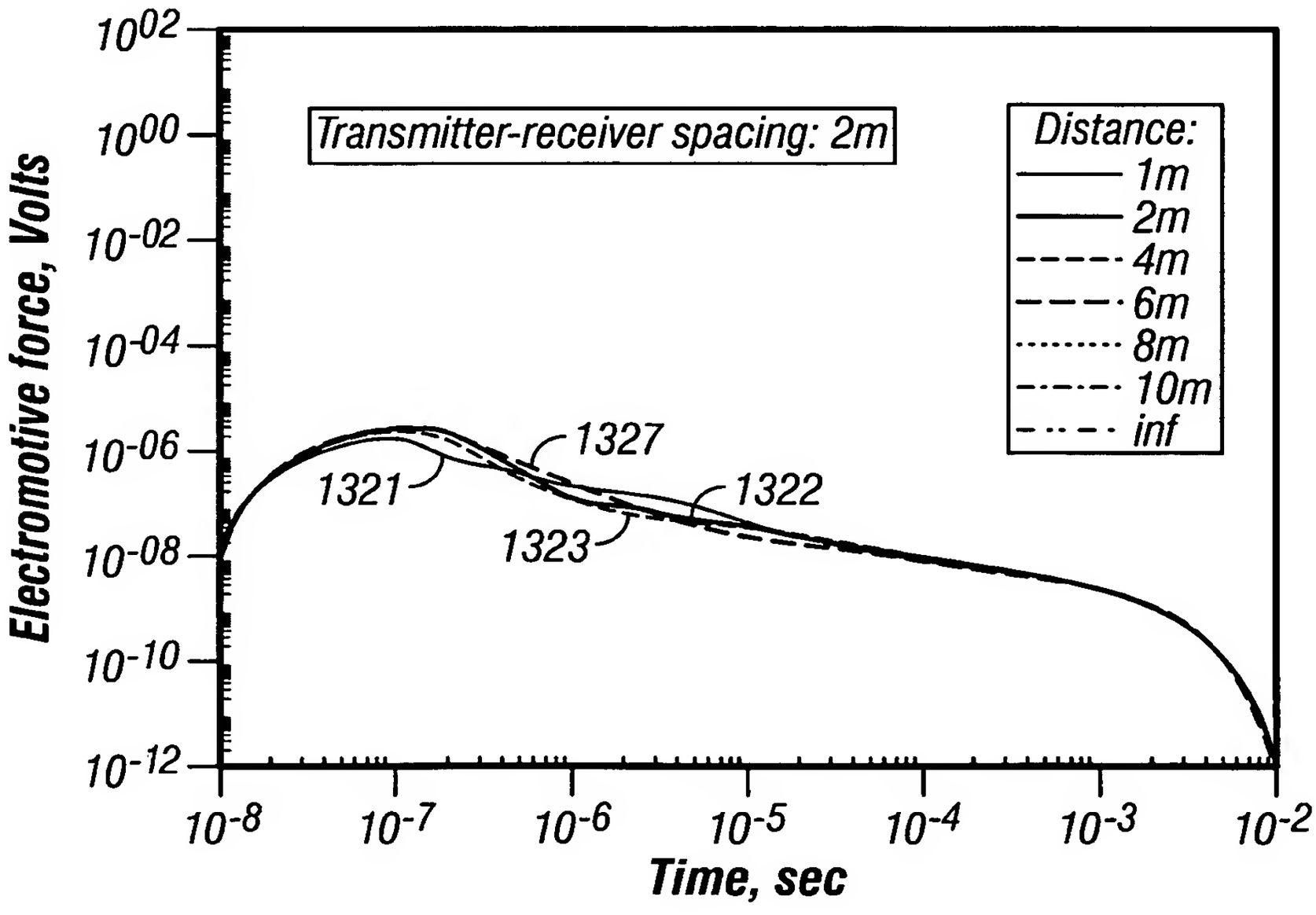

FIG. 13C

10/10

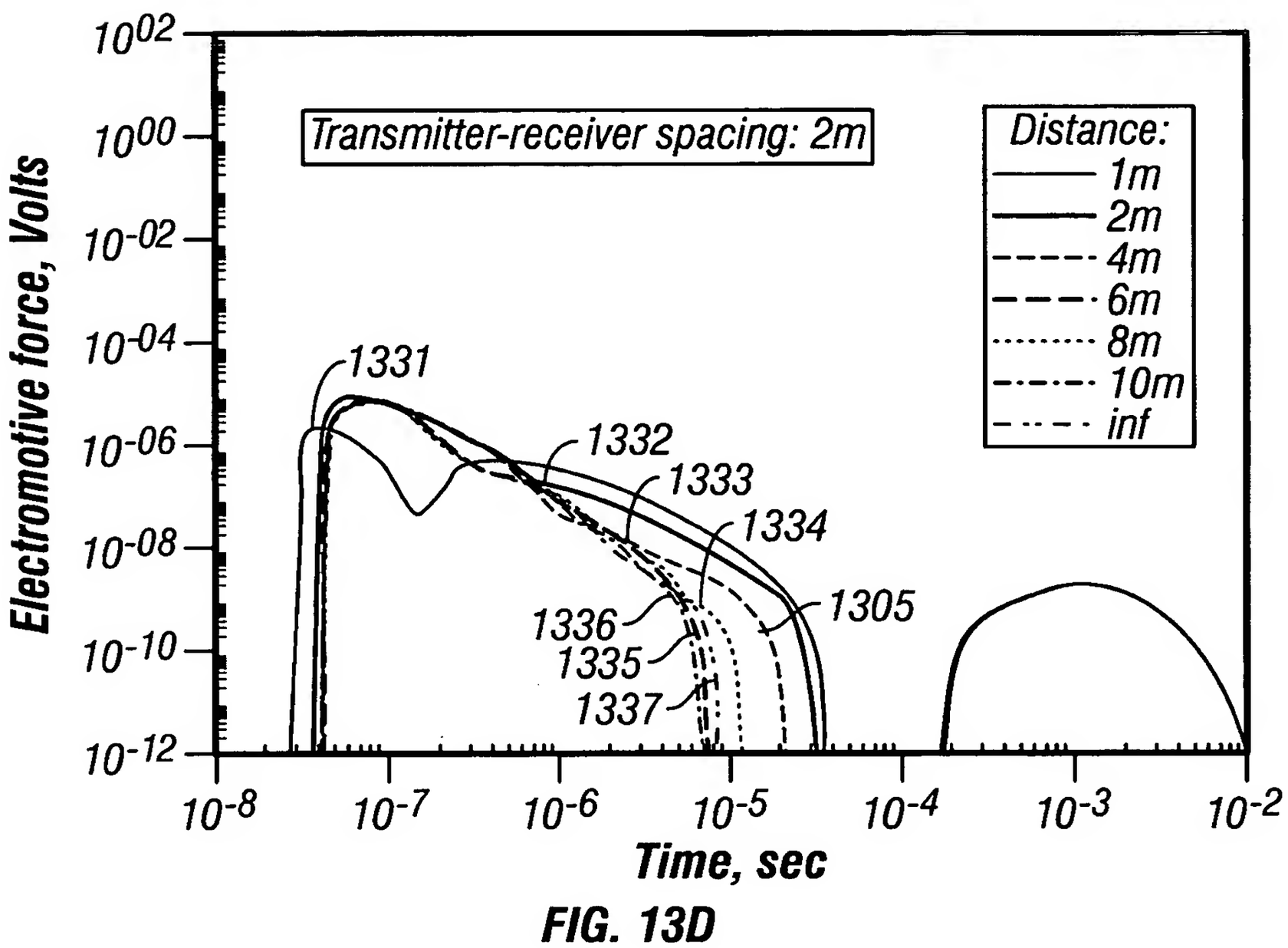
Transmitter-receiver spacing: 2m
Distance:
1m
2m
4m
6m
8m
10m
inf
1331
1332
1333
1334
1305
1336
1335
1337
Electromotive force, Volts
10^02
10^00
10^-02
10^-04
10^-06
10^-08
10^-10
10^-12
10^-8
10^-7
10^-6
10^-5
10^-4
10^-3
10^-2
Time, sec

FIG. 13D